Tests Included in Your Screening: METABOLIC PANEL, Lipid Panel, and Complete Blood Count

METABOLIC PANEL (Comprehensive Metabolic Panel, or CMP)

The Metabolic Panel (CMP) is a frequently ordered group of 14 tests that gives your doctor important information about the current status of your kidneys, liver, and electrolyte and acid/base balance as well as of your blood sugar and blood proteins. Abnormal results, and especially combinations of abnormal results, can sometimes indicate a problem that needs to be addressed.

This battery of tests is used as a broad screening tool. The CMP is routinely ordered as part of a blood work-up for a medical exam or yearly physical. Usually fasting for 8 to 12 hours prior to the blood draw is preferred. While the tests are sensitive, they do not usually tell your doctor specifically what is wrong. Abnormal test results or groups of test results are usually followed-up with other specific tests to confirm or rule out a suspected diagnosis.

The CMP includes:

	General Tests	Proteins	Electrolytes	Kidney Tests	Liver Tests
Sodium			x		
Potassium			x		
Chloride, Blood			x		
Blood Urea Nitrogen (BUN)				x	
Creatinine, Blood				x	
Glucose (Blood Sugar)	x				
Bilirubin, Total					x
AST/SGOT					x
Alk Phosphatase (ALP)					x
Calcium	x				
Protein, Total		x			
Albumin, Serum		x			
BUN/CREATININE Ratio				x	
A/G Ratio, Calculated	x				
Globulin, Calculated	x				
CO2			x		
AGAP (Anion Gap)	x				
ALT/SGPT					x

Sodium

Blood sodium is often abnormal with many diseases; your doctor may order this test if you have symptoms of illness involving the brain, lungs, liver, heart, kidney, thyroid, or adrenal glands.

When sodium falls slowly there may be no symptoms. That is why sodium levels are often checked even if you don't have any symptoms. A low level of blood sodium means you may have hyponatremia, which is usually due to too much sodium loss, too much water intake or retention, or to fluid accumulation in the body (edema). If sodium falls quickly, you may feel weak and fatigued.

A high blood sodium level (hypernatremia) is almost always due to excessive loss of water (dehydration) without enough water intake. Hypernatremia may be due to increased salt intake without enough water, Cushing's syndrome, or too little anti-diuretic hormone (called diabetes insipidus).

Potassium

The most common cause of elevated potassium levels is kidney disease, but many medications can decrease potassium excretion from the body and therefore show high potassium results. Low potassium levels can occur if you have diarrhea and vomiting, or if you are sweating excessively. Once your doctor discovers the reason for high or low potassium levels, s/he can start treatment if necessary.

Chloride

If your sodium measurement is abnormal, the doctor will look at whether the chloride measurement changes in the same way. This helps the doctor know if there is also a problem with acid or base and helps him/her to guide treatment.

Increased levels of chloride (called hyperchloremia) usually indicate dehydration, but can also occur with any other problem that causes high blood sodium. Decreased levels of chloride (called hypochloremia) can occur with any disorder that causes low blood sodium. Hypochloremia can also occur with prolonged vomiting, chronic diarrhea, emphysema, or other chronic lung disease.

Blood Urea Nitrogen (BUN)

The BUN level, usually with tests for creatinine, is used to evaluate kidney function.

High BUN levels suggest impaired kidney function. This may be due to acute or chronic kidney disease. However, there are many things besides kidney disease that can affect BUN levels such as decreased blood flow to the kidneys as in congestive heart failure, shock, stress, recent heart attack, severe burns, conditions that cause obstruction of urine flow, or dehydration.

Low BUN levels are not common and are not usually a cause for concern. They can be seen in severe liver disease or malnutrition but are not used to diagnose or monitor these conditions. Low BUN is also seen in normal pregnancy.

Creatinine, Blood

This test is used to determine whether your kidneys are functioning normally. Increased creatinine levels in the blood suggest possible problems that affect kidney function, or possibly muscle injury. Low levels are not common and are not usually a cause for concern.

Glucose (Blood Sugar)

The glucose test is a snapshot, a still photograph of your glucose level at the time that it was collected. The fasting blood glucose level (collected after an 8-12 hour fast) is used to screen for and diagnose diabetes and pre-diabetes. (It is important to note that if you did not fast for 8-12 hours prior to the collection of the blood specimen, the test results may not be valid.)

High levels of glucose most frequently indicate diabetes but many other diseases and conditions can also cause elevated glucose. The following information summarizes the meaning of the test results. These are based on the clinical practice recommendations of the American Diabetes Association.

Fasting Blood Glucose	
From 70 to 110	normal glucose tolerance
From 111 to 125	impaired fasting glucose
126 and above	possible diabetes

Bilirubin, Total

Bilirubin is measured to diagnose and/or monitor liver diseases (such as cirrhosis, hepatitis, or gallstones). Significantly elevated bilirubin levels strongly suggest a medical condition that must be evaluated and treated.

When bilirubin levels are high, a condition called jaundice (a yellowing of the skin and the whites of the eyes) occurs, and further testing is needed to determine the cause. Too much bilirubin may mean that too many red cells are being destroyed, or that the liver is incapable of removing bilirubin from the blood.

AST / SGOT (Serum glutamic-oxaloacetic transaminase, also called AST or SGOT)

Testing for AST is usually used to detect liver damage. AST levels are also often compared with levels of other liver enzymes, alkaline phosphatase (ALP), and alanine aminotransferase (ALT), to determine which form of liver disease is present.

Persons who have mild symptoms, such as fatigue, may be tested for ALT to make sure they do not have chronic liver disease. ALT is often measured to monitor treatment of persons with liver disease, and may be ordered either by itself or along with other tests.

Very high levels of AST (more than 10 times the highest normal level) are usually due to acute hepatitis, often due to a viral infection. In acute hepatitis, AST levels usually stay high for about 1–2 months, but can take as long as 3–6 months to return to normal. In chronic hepatitis, AST levels are usually not as high, often less than 4 times the highest normal level. In chronic hepatitis, AST often varies between normal and slightly increased, so doctors typically will order the test frequently to determine the pattern.

Pregnancy may decrease AST levels. A shot or injection of medicine into muscle tissue, or even strenuous exercise, may increase AST levels. In rare instances, some drugs can damage the liver or muscle, increasing AST levels. This is true of both prescription drugs and some "natural" health products. If your doctor finds that you have high levels of AST, tell him or her about all the drugs and health products you are taking.

Alk Phosphatase (Alkaline Phosphotase, or ALP)

ALP is generally part of a routine lab testing profile, often with a group of other tests called a liver panel. It is also usually ordered along with several other tests if a patient seems to have symptoms of a liver or bone disorder.

When a person has evidence of liver disease, very high ALP levels can tell the doctor that the person's bile ducts are somehow blocked. Often, ALP is also high in persons who have cancer that has spread to the liver or the bones.

Calcium

Blood calcium is tested to screen for, diagnose, and monitor a range of conditions relating to the bones, heart, nerves, kidneys, and teeth. Blood calcium levels do not directly tell how much calcium is in the bones, but rather, how much total calcium or ionized calcium is circulating in the blood.

A normal calcium result with other normal lab results means that you have no problems with calcium metabolism.

A high calcium level is called hypercalcemia. You have too much calcium in your blood and may need treatment for an underlying condition. Low calcium levels, called hypocalcemia, can mean that you do not have enough calcium or protein in your blood. The most common cause of low total calcium is low protein levels, especially low albumin.

Protein, Total

Total protein measurements can reflect nutritional status, kidney disease, liver disease, and many other conditions. If total protein is abnormal, further tests must be performed to identify which protein fraction is abnormal, so that a specific diagnosis can be made.

The calculated ratio of albumin to globulins is termed the A/G ratio. Normally, there is a little more albumin than globulins, giving a normal A/G ratio of slightly over 1. Because disease states affect the relative changes in albumin and globulins in different ways, this may provide a clue to the physician as to the cause of the change in protein levels. A low A/G ratio may reflect overproduction of globulins. A high A/G ratio suggests underproduction of immunoglobulins. More specific tests, such as albumin, liver enzyme tests, and serum protein electrophoresis must be performed to make an accurate diagnosis.

Albumin, Serum

Since albumin is low in many different diseases and disorders, albumin testing is used in a variety of settings to help diagnose disease, to monitor changes in health status with treatment or with disease progression, and as a screen that may serve as an indicator for other kinds of testing.

A physician might order a blood albumin test (usually along with several other tests) if a person seems to have symptoms of a liver disorder or kidney disorder. Doctors may also order blood albumin tests when they want to check a person's nutritional status, for example, when someone has lost a lot of weight.

High Albumin levels usually reflect dehydration. Low Albumin levels can suggest kidney or liver problems, inflammation, shock, or malnutrition.

BUN / Creatinine Ratio

Comparing BUN and Creatinine can be helpful in narrowing down causes for certain conditions. For example, an increased ratio may be due to a decrease in the flow of blood to the kidneys, such as congestive heart failure or dehydration. It may also be seen with increased protein, from gastrointestinal bleeding, or increased protein in the diet. The ratio may be decreased with liver disease or malnutrition.

A/G Ratio, Calculated & Globulin, Calculated

Low total protein levels can suggest a liver disorder, kidney disorder, or a disorder in which protein is not digested or absorbed properly. Some laboratories also report the calculated ratio of **albumin to globulins**, termed the **A/G ratio**. Normally, there is a little more albumin than globulins, giving a normal A/G ratio of slightly over 1. Because disease states affect the relative changes in albumin and globulins in different ways, this may provide a clue to the physician as to the cause of the change in protein levels. A low A/G ratio may reflect overproduction of globulins or underproduction of albumin or selective loss of albumin from the circulation. A high A/G ratio suggests underproduction of immunoglobulins. More specific tests must be performed to make an accurate diagnosis.

CO2

When you breath, you bring oxygen (O2) into your lungs and release carbon dioxide (CO_2). The CO_2 test measures the total carbon dioxide in your blood. The CO_2 test is usually tested along with sodium, potassium, and chloride as it is the balance of the four that gives your doctor the most information.

AGAP (Anion Gap, or AG)

Anion gap (AGAP) is frequently used in hospitals and/or emergency rooms to help diagnose and monitor acutely ill patients. Specifically, the anion gap evaluates the difference between measured and unmeasured electrical particles (ions or electrolytes) in the fluid portion of the blood. According to the principle of electrical neutrality, the number of positive ions and negative ions should be equal. However, not all ions are routinely measured. The calculated AG result represents the *unmeasured* ions and primarily consists of anions (or negatively charged ions), hence the name "anion gap." The most commonly used formula is: Anion Gap (AG) = Sodium - (Chloride + Carbon Dioxide)

ALT / SGPT (Alanine Amino Transferase, also called ALT or SGPT)

Testing is usually used to detect liver damage. ALT/SGPT levels are also often compared with levels of other liver enzymes, ALP and AST/SGOT to determine which form of liver disease is present.

LIPID PANEL

The Lipid Panel is a group of tests that are often ordered together to determine risk of coronary heart disease. The tests that make up a lipid profile are tests that have been shown to be good indicators of whether someone is likely to have a heart attack or stroke caused by blockage of blood vessels (hardening of the arteries).

The Lipid Panel includes:

1) Cholesterol, Total
2) Triglyceride
3) HDL (high density lipoprotein, or "good" cholesterol)

4) LDL (low density lipoprotein, or "bad" cholesterol)
5) Cholesterol/HDL Ratio is not on your lab report. However, you can calculate it by dividing your cholesterol result by your HDL result. For example, cholesterol 225 divided by HDL 50 = 4.5. Many physicians advise that it is best if this ratio is 4.5 or less.

The Lipid Panel is used as one tool to help guide doctors in deciding how a person at risk should be treated. The results of the Lipid Panel are considered, along with other known risk factors of heart disease, to develop a plan of treatment and follow-up.

American Heart Association Guidelines			
Cholesterol	Less than 200 (Desirable)	200-239 (Borderline High)	240 and above (High)
Triglycerides	Less than 150 (Normal)	150 to 199 (Borderline High)	200-499 (High) 500 and above (Very High)
HDL ("good" cholesterol – you want higher numbers of these)	60 and above (Low Risk)	40 to 59 (Needs improvement)	Less than 40 (Higher Risk)
LDL ("bad" cholesterol – you want lower numbers of these)	Less than 100 (Optimal)	100 to 129 (Near optimal)	130 to 159 (Borderline High) 160 to 189 (High) 190 and above (Very High)

Cholesterol, Total

Cholesterol is a substance (a steroid) that is essential for life. It forms the membranes for cells in all organs and tissues in your body. It is used to make hormones that are essential for development, growth and reproduction. It forms bile acids that are needed to absorb nutrients from food. A small amount of your body's cholesterol circulates in the blood in complex particles called lipoproteins. These lipoproteins include some particles that carry excess cholesterol away for disposal (see HDL, good cholesterol) and some particles that deposit cholesterol in tissues and organs (see LDL, bad cholesterol). The test for cholesterol measures all cholesterol (good and bad) that is carried in the blood by lipoproteins.

Triglycerides

Triglycerides are a form of fat. They are derived primarily from the fats you eat or are made by your body from excess calories. There are various causes of high triglycerides, but the main cause is a high fat diet. As such, you can lower your triglycerides thru diet. However, diet changes may not be enough.
High triglycerides are a risk factor to be considered because high levels are frequently associated with high LDL cholesterol (bad) and low HDL (good). The mechanism of this association is not fully understood, but high triglycerides are considered a heart attack risk factor.

Blood tests for triglycerides are usually part of a Lipid Panel used to identify the risk of developing heart disease. If you are diabetic, it is especially important to have triglycerides measured as part of any lipid testing since triglycerides increase significantly when blood sugar is out of control.

It is unusual to have high triglycerides without also having high cholesterol. Most treatments for heart disease risk will be aimed at lowering cholesterol. However, the type of treatment used to lower cholesterol may differ depending on whether triglycerides are high or normal.

HDL (High Density Lipoprotein)

HDL is one of the classes of lipoproteins that carry cholesterol in the blood. HDL is considered to be beneficial because it removes excess cholesterol and disposes of it. Hence HDL cholesterol is often termed "good" cholesterol. The test for HDL measures the amount of HDL-cholesterol in blood. Higher numbers of this "good" cholesterol are better.

VLDL (Very Low Density Lipoprotein)

Very Low Density Lipoprotein (VLDL) is one of three major "lipid packets," which also include high density lipoprotein (HDL) and low density lipoprotein (LDL). Each one of these "packets" contains triglyceride and cholesterol, but in varying amounts unique to each packet. LDL contains mainly cholesterol, while HDL contains mostly the excess cholesterol removed from tissues and carried back to the liver, and VLDL contains mainly triglyceride. It contains so much triglyceride, in fact, that **you can get an idea of what the VLDL concentration is by dividing the triglyceride value by 5.**

At present, there is no direct way of measuring VLDL, so the direct measurement of triglyceride is considered the next best thing, and the calculation is done if needed.

LDL (Low Density Lipoprotein)

LDL is a type of lipoprotein that carries cholesterol in the blood. LDL is considered to be undesirable because it deposits excess cholesterol in walls of blood vessel and contributes to "hardening of the arteries" and heart disease. Hence LDL cholesterol is often termed "bad" cholesterol. The test for LDL measures the amount of LDL cholesterol in blood. Lower numbers of this "bad" cholesterol are better.

A CBC is usually ordered as part of a routine medical exam. It is also ordered for a variety of other more specific situations. It is used as a broad screening test to check for such disorders as anemia (decrease in red blood cells or hemoglobin), infection, and many other diseases. It is actually a panel of tests that examine different parts of the blood. Results from the following tests provide a broad picture of your health:

WBC Count (white blood cells) is a count of the actual number of white blood cells per volume of blood. Both increases and decreases can be significant.

RBC Count (red blood cells) a count of the actual number of red blood cells per volume of blood. Both increases and decreases can point to abnormal conditions.

Hemoglobin measures the amount of oxygen-carrying protein in the blood.

Hematocrit measures the amount of space red blood cells take up in the blood. It is reported as a percentage.

MCV (mean corpuscular volume) is a measurement of the average size of your red blood cells (RBC). The MCV is elevated when your RBCs are larger than normal, for example in anemia caused by vitamin B12 deficiency. When the MCV is decreased, your RBCs are smaller than normal, such as is seen in iron deficiency anemia.

MCH (mean corpuscular hemoglobin) is a calculation of the amount of oxygen-carrying hemoglobin inside your RBCs.

MCHC (mean corpuscular hemoglobin concentration) is a calculation of the percentage of hemoglobin in the RBCs.

RDW (red cell distribution width) is a calculation of the variation in the size of your RBCs. In some anemias, the amount of variation in RBC size may help a doctor evaluate the severity of a condition.

The **Platelet Count** is the number of platelets in a given volume of blood. Both increases and decreases can point to abnormal conditions of excess bleeding or clotting.

MPV (mean platelet volume) is a machine-calculated measurement of the average size of your platelets. New platelets are larger, and an increased MPV occurs when increased numbers of platelets are being produced. MPV gives your doctor information about platelet production in your bone marrow.

Differential (of the types of white blood cells)

The Differential looks at the types of white blood cells present. There are five different types of white blood cells, each with its own function in protecting us from infection. The Differential classifies and tests a person's white blood cells by type. The types are: :

1) Lymphocytes, 2) Monocytes, 3) Neutrophils, 4) Eosinophils, 5) Basophils